Proposal Summary

Solar Swimming Pool and Spa Heating

Updated: January 26, 2023
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Introduction

The document summarizes proposed revisions to the California Energy Code (Title 24, Part 6) that will be discussed during a utility-sponsored stakeholder meeting on February 1st, 2023. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email info@title24stakeholders.com by February 15, 2023.

Measure Description

The proposal includes measures that save energy on pool heating:

1. **Require Mandatory Solar Heating for Pools and Spas.** The proposed code change would require solar thermal pool and spa (except portable electric spas) heating systems in nonresidential, multifamily, and newly constructed single-family buildings with heated swimming pools and spas. The surface area of the solar collectors installed would be equal to or greater than 70 percent of the surface area of the pool.
2. **Explore installation requirement that pool pumping systems have a variable-speed control for the pool pump.** Variable-speed controls provide the opportunity to optimize energy consumption by adjusting the flow rate. Often the flow rate exceeds what is required by health and safety codes. A variable-speed control can adjust the speed of the pump to only provide the needed flow rate. Lower flow rates use less energy while still maintaining the cleanliness of the pool.
3. **Clean up and clarify existing requirements.** While we are modifying the requirements for pools and spas, the CASE Team will also explore opportunities to update language as needed based on advances in technology and standard design practices, and existing federal and state regulations applicable to pool heating products. Clarifying provisions are being added in section 110.4(a) to specify that products and equipment not meeting definitions in Appliance Efficiency Regulations shall not be used as pool heaters. The CASE team is also

proposing a cleanup of section 150.0(p) in an attempt to harmonize Title 24, Part 6, with provisions in the federal regulations on dedicated-purpose pool pumps.

4. **Establish requirements for pool insulation.** This proposal would explore insulation requirements for pools and spas that are either installed in newly constructed buildings or added to an existing building. This would not apply to portable electric spas. Portable electric spas shall meet the requirements of ANSI/APSP/ICC-14.

Data Needs/Stakeholder Information Requests

Mandatory solar heating requirements for pools and spas

- **Energy Savings** – quantifiable savings (in BTUs, kWh, etc.) that can be attributed to a specific measure
    1) Improved Savings Calculations – Need field validations studies to support the measure.
        a) Need California-specific commercial and residential market penetration and demand.
    2) Annual Energy Savings Calculations – Need survey-based data for all climate zones in California.
        b) Thus far we have energy savings data from the following climate zones: Z04, Z10, Z06, Z15, Z08, Z09
- **Technical Feasibility**
    1) How well-established is solar thermal pool and spa heating in the industry—or other types of pool and spa heating?
    2) How is a heat pump pool heater (HPPH) applied in nonresidential pool and spa applications, i.e., what auxiliary heating equipment is typically used with such systems? How would a HPPH handle a cold start and pick-up?
    3) Would a HPPH require a heat exchanger or can HPPHs operate independently of the heat exchanger and boiler installed application?
    4) What are the possible approaches for heating an Olympic-sized pool year-round somewhere cold like Arcata if gas is not available?
    5) With available HPPH technology what is the largest gallons pool for year-round outdoor public use and year-round indoor public use? What is the pool volume limitation if the swimming is seasonal from April to October in California for outdoor public pools?
    6) If we could add solar thermal collectors to the year round pool how does this impact the need capacity of a HPPH for a large pool?

7) Under what conditions do unglazed and glazed systems need to be winterized?
8) Following up on question 7 above, do the freeze protection provisions in OG-400 and the freeze tolerance provisions in OG-100 adequately address any freezing-related issues for all 16 California climate zones? Assuming the answer is yes, do you have any concerns with referencing the OG-100 or OG-400 certification directories? The approach is currently being taken in Title 24, Part 6, for solar water heating systems.
9) What sizing recommendations do contractors provide to clients? Are they based upon calculations, sizing by pool area, etc.?

- **Market Readiness** – Below are questions on the availability in the market, and certainty regarding performance, reliability, and cost:
    1) What are the market segments in pool heating for HPPH/Gas Heating and Solar Heating equipment and installations?
    2) Is it by market residential, multifamily or commercial or by size or capacity of the system?
    3) What types of solar pool heating products are available? What markets do the different types serve?
    4) What differences are there in the new construction vs. retrofit market for solar pool heating?
    5) What information describes the current pool and spa heating practices in California? How often are pools and spas heated seasonally vs. year-round? How does the choice of heating equipment influence heating behavior?
    6) What information is available on how pool heating systems are used?
    7) Do you have any recommended California-specific data sources citing costs associated with solar pool heating installations?
    8) What supplemental pool heating systems are typically used in the field with solar collectors?
    9) Similar to question 8 above, what is the percentage of unglazed, glazed, combined PV/glazed, and glycol heat exchange in the residential market? In the commercial market?
    10) Can you please confirm how pool and solar contractors collaboratively work on projects dealing with newly constructed buildings and existing buildings?
- **Non-energy Benefits**
    1. The Statewide CASE recognizes potential reduced water use, GHG emission reductions, and reduced fossil fuel consumption as a result of

this measure. We would appreciate further input on potential non-energy benefits.

2. Sizing considerations – are pool heaters for commercial pools sized only for seasonal use or year-round use?

Installation requirement that pool pumping systems have a variable-speed control for the pool pump

- **Energy Savings** – quantifiable savings (in BTUs, kWh, etc.) that can be attributed to a specific measure.
    1) Estimates of the opportunity to right size pool pump operation by reducing the flow to meet pool health and safety requirements.
    2) Estimates of the opportunity through smart pumping for pool pump to adjust flow to changes in the system pressure due to condition of the pool filter.
- **Technical Feasibility** – The Statewide CASE Team would appreciate information on examples of retrofits to existing pools and new pool construction that have demonstrated the feasibility of variable speed control.
    1) Please describe other feasible ways to alter water flow rate to reduce energy costs such as the use of secondary pumps, staged pumping, or throttle valves.
- **Market Readiness** – Below are questions on the availability in the market, and certainty regarding performance, reliability, and cost:
    1) Please describe industry practices used to set flow rates during the pump commissioning process and how these practices yield energy savings.
- **Costs** - The Statewide CASE Team would appreciate information on the costs of retrofitting existing pools with variable speed control technology and the incremental cost when added to new pools.

Pool Insulation

- **Energy Savings**
    1) What are the appropriate definitions for the terms below? Do you have any suggestions for the terms used in existing Title 24 language, the “pool” term in ANSI/ASHRAE/IES Standard 90.1-2019, or the “pools, residential” term in ANSI/ASHRAE/IES Standard 90.2-2018?
        i. Spa pools
        ii. Pool system
    2) What data sources do you recommend for mean ground temperatures for a variety of climate zones?

3) Is an 83°F to 93°F temperature range adequate for aquatic centers equipped with pool heating equipment, or are there other temperatures that may be deemed as being more comfortable across a variety of age groups?

- **Technical Feasibility**
  1) What are reasonable prototype sizes for in-ground spas and in-ground therapy pools, and above-ground applications?
  2) What is the base construction practice for in-ground spas and pools, and above-ground applications?
  3) What types of insulation materials are used in pool and spa applications (material, R-value per inch, density, etc.)?
  4) Are there any opportunities for increasing insulation stringency over the course of resurfacing a pool or spa?
- **Market Readiness**
  1) What are reasonable construction methods for providing R-12 insulation in pool and spa applications?
- **Costs**
  1) What are the incremental costs of adding insulation in pool and spa applications in both newly constructed buildings and alterations to existing buildings? Are there special considerations for gunite, shotcrete, etc.?
  2) What is the expected useful life of the shell of the pool or spa (not the interior surface which may be resurfaced several times)?

Data may be provided anonymously. To participate or provide information, please email Melissa Schellinger Gutierrez, mGutierrez@energy-solutions.com directly and cc info@title24stakeholders.com.

Draft Code Language

The draft code language will propose revisions to installation provisions set forth in sections 110.4(b) and 150.0(p) while also proposing an introduction of a new nonresidential appendix prescribing eligibility criteria for solar pool or spa systems.

The proposed changes to the Standards and Reference Appendices will be provided below. Changes to the 2022 documents are marked with underlining (new language) and ~~strikethroughs~~ (deletions).

SECTION 110.4 – MANDATORY REQUIREMENTS FOR POOL AND SPA SYSTEMS AND EQUIPMENT

(a) **Certification by Manufacturers.** Any pool and spa heating system or equipment may be installed only if the manufacturer has certified that the system or equipment has all of the following:

1. **Efficiency.** ~~A thermal efficiency that complies with the Appliance Efficiency Regulations~~ All installed pool and spa heating systems or equipment subject to State or federal appliance efficiency standards~~,~~ listed in the Commission's directory of certified equipment shall comply with the Appliance Efficiency Regulations. ~~.showing compliance with applicable standards~~ Products and equipment not meeting the definitions set forth in section 20 CCR § 1602 of the Appliance Efficiency Regulations shall be prohibited from being installed for all applications applicable to this section.
2. **On-off switch.** A readily accessible on-off switch, mounted on the outside of the heater that allows shutting off the heater without adjusting the thermostat setting; and
3. **Instructions.** A permanent, easily readable, and weatherproof plate or card that gives instruction for the energy efficient operation of the pool ~~or~~ and spa heater and for the proper care of pool ~~or~~ and spa water when a cover is used; and
4. **Electric resistance heating.** No electric resistance heating.

   Exception 1 to Section 110.4(a)4: Listed package units with fully insulated enclosures, and with tight- fitting covers that are insulated to at least R-6.

   Exception 2 to Section 110.4(a)4: Pools or spas deriving at least 60 percent of the annual heating energy from site solar energy or recovered energy.

(b) **Installation.** Any pool ~~or~~ and spa system or equipment shall be installed with all of the following:

1. **Piping.** At least 36 inches of pipe shall be installed between the filter and the heater or dedicated suction and return lines, or built-in or built-up connections shall be installed to allow for the future addition of solar heating equipment;
2. **Covers.** A cover for outdoor pools or outdoor spas that have a heat pump or gas heater; and
3. **Directional inlets and time switches for pools.** If the system or equipment is for a pool:

   i. The pool shall have directional inlets that adequately mix the pool water; and

ii. A time switch or similar control mechanism shall be installed as part of a pool water circulation control system that will allow all pumps to be set or programmed to run only during the off-peak electric demand period and for the minimum time necessary to maintain the water in the condition required by applicable public health standards.

(c) **Pool and Spa Heating System.** Installed pool and spa heating system or equipment shall meet one of the following:

1. Include a solar pool and/or spa system with a solar collector surface area that is equivalent to at least 70% of the pool surface area. Solar pool and spa heating systems and collectors shall be certified and rated by the Solar Rating and Certification Corporation (ICC-SRCC), the International Association of Plumbing and Mechanical Officials, Research and Testing (IAPMO R&T), or by a listing agency that is approved by the Executive Director. The system shall meet the installation criteria in Section 150.0(p) and Reference Nonresidential Appendix NA9; or
2. Derive at least 60 percent of the annual heating energy from on-site renewable energy or site recovered energy; or
3. In all Climate zones, a heat pump pool heater shall have a Coefficient of Performance (COP) of not less than 5.5 at the High Air Temperature-Mid Humidity rating condition rated in accordance with 10 C.F.R. section 430.23(p) (Appendix P to subpart B of part 430). In addition, a heat pump pool heater installed in climate zones 1, 2, 4, 11, 12, 14, and 16, shall have a Coefficient of Performance (COP) of not less than 4.0 at the Low Air Temperature-Mid Humidity rating condition rated in accordance with 10 C.F.R. section 430.23(p) (Appendix P to subpart B of part 430). A heat pump pool heater shall be sized using the following steps:
   i. Determine desired pool temperature.
   ii. Determine average temperature for the coldest month of pool use.
   iii. Determine temperature rise by subtracting the average temperature for the coldest month from the desired pool temperature.
   iv. Calculate the pool surface area in square feet.
   v. Use the following formula to determine the Btu/h output requirement of the heater: Pool Area x Temperature Rise x 12

Exception 1 to Section 110.4(c): Portable electric spas compliant with the Appliance Efficiency Regulations.

Exception 2 to Section 110.4(c): Additions and alterations to single-family buildings with existing pool and spa heating systems.

Joint Appendix 15 – Eligibility Criteria for Energy Efficiency Measures on Solar Pool and Spa systems

Solar pool and spa systems, and/or collectors shall be certified and rated by the Solar Rating and Certification Corporation (ICC-SRCC), the International Association of Plumbing and Mechanical Officials, Research and Testing (IAPMO R&T), or by a listing agency that is approved by the Executive Director.
To use collectors with the SRCC OG-100 certification and rating, the installed system shall meet the following eligibility criteria:

(a) Include all the features modeled and generated in the Commission approved calculations.
(b) The collectors shall be installed according to manufacturer's instructions.
(c) The collectors shall be located in a position that is not shaded by adjacent buildings or trees between 9:00 AM and 3:00 PM (solar time) on December 21.

To use a solar pool heater with the ICC-SRCC OG-400 certification and rating, the installed system shall meet the following eligibility criteria:

(a) The collectors shall face within 35 degrees of south and be tilted at a slope of at least 3:12.
(b) The system shall be installed in the exact configuration for which it was rated. The system shall have the same collector(s), piping, pump, vacuum relief valve, controls, and other components used to establish the rated condition.
(c) The system shall be installed according to manufacturer's instructions.
(d) The collectors shall be located in a position that is not shaded by adjacent buildings or trees between 9:00 AM and 3:00 PM (solar time) on December 21.

Section 150.0(p)

(a) **Pool Systems and Equipment Installation.** Any residential pool system or equipment installed shall comply with the applicable requirements of Section 110.4, as well as the requirements listed in this section.

1. **Pump sizing and flow rate.**

A. All installed pumps and pump motors ~~installed~~ subject to State or federal appliance standards shall be listed in the Commission's directory of certified equipment and shall comply with the Appliance Efficiency Regulations.

B. ~~All pump flow rates shall be calculated using the following system equation:~~

~~$H = C \times F^2$~~

~~WHERE:~~

~~H is the total system head in feet of water.~~

~~F is the flow rate in gallons per minute (gpm).~~

~~C is a coefficient based on the~~

~~volume of the pool: 0.0167~~

~~for pools less than or equal to~~

~~17,000 gallons. 0.0082 for~~

~~pools greater than 17,000~~

~~gallons.~~

C. Filtration pumps shall be sized, or if programmable, shall be programmed, so that the filtration flow rate is not greater than the rate needed to turn over the pool water volume in 6 hours or 36 gpm, whichever is greater; and

D. Pump motors used for filtration ~~with a capacity of 1 hp or more shall be multispeed~~ shall meet the applicable standards set forth in 20 CCR § 1605.3 of the Appliance Efficiency Regulations; and

~~E. Each auxiliary pool load shall be served by either separate pumps or the system shall be served by a multispeed pump; and~~

~~**EXCEPTION to Section 150.0(p)1E:** Pumps less than 1 hp may be single speed.~~

~~A.~~ E. Multispeed pumps shall have controls which default to the filtration flow rate when no auxiliary pool loads are operating; and

~~B.~~ F. For multispeed pumps, the controls shall default to the filtration flow rate setting within 24 hours and shall have an override capability for servicing.